

Air pollution negatively affect the health of humans and animals (wild and farmed). Polycyclic aromatic hydrocarbons (PAHs) are common air pollutants that are by-products of incomplete combustion of organic matter. PAHs are compounds that have always been presented in the environment due to the fact that they are formed as a result of natural processes such as volcanic eruptions or forest fires. However, compared to the amount of PAHs produced by human activity, the amount of naturally produced PAHs is a minor addition. The main cause of air pollution in Poland is combustion of low-quality solid fuels, such as coal and wood, in low efficiency ovens for domestic heating. The annual concentration of benzo[a]pyrene, which is a marker compound of this group, significantly exceeds the standards established by EU law, i.e. 1 ng/m³. Although recently there has been a growing awareness of the society regarding the negative impact of air pollution on the health of both humans and animals, unfortunately still too little action is taken to reduce the emission of compounds such as PAHs into the atmosphere. Therefore, more reliable data is needed to convince people to change their behavior when it comes to heating homes or burning waste. The aim of this project is to determine the effect of mixture of 16 PAHs, commonly found in the environment and determined in the yolk of chicken eggs, on the functions of the chicken ovary and the possibility of their carcinogenic effect on epithelial cells, which are the source of 90% of all ovarian tumors. The ovary of the laying hen is a widely used model in both endocrine and cancer research. The advantage of using the chicken model in research is its availability as well as low purchase and maintenance costs. Moreover, the domestic hen is a very good model for studying neoplastic processes in the ovary. In chickens, as in women, there is incessant spontaneous ovulation. Population studies have shown that a greater number of ovulation during the life increases the risk of developing ovarian cancer. It is considered that the frequency of ovulation in laying hens, relatively spread over time, corresponds to that of women, so that both hens and humans are likely to develop ovarian cancer with high prevalence. Hens will be administrated, for 7 and 28 days, two mixtures containing 16 PAHs in concentrations found in the egg yolks. One mixture will consist of doses corresponding to the concentration of PAHs in the free-range hen egg yolks, and the other to the concentration of PAHs in the cage hen egg yolks. At the beginning of the experiments and following the short-term (on 7th day of the experiment) and long-term (on 28th day of experiment) exposure to PAH mixtures, the levels of 16 PAHs (in the hen's blood and egg yolks) and the levels of luteinizing hormone (LH) and steroid hormones: progesterone, testosterone and estradiol (in the hen's blood) will be measured. At the last day of experiments, the gene expression of proteins involved in the process of the steroid hormone synthesis will be determined. In the next stage, the influence of PAH mixtures on the biotransformation processes in the liver and ovary as well as on the growth and development of ovarian follicles, which form the environment for the maturation of oocytes, will be determined. Proper growth and development of follicles and proper levels of LH and steroid hormones determine the proper course of reproductive processes. The number of eggs laid by the hen depends on the number of oocytes formed in the ovary and the rate of their development, so the results obtained in this project may explain whether PAHs can contribute to hen ovarian dysfunctions, like inhibition of ovulation or the appearance of multiple ovulations. This is important because the main goal of poultry breeding is to ensure maximum reproductive activity, which in turn affects the profitability of poultry production. The objective of the second part of the research will be to clarify whether the mixture of 16 PAHs may contribute to the formation of an ovarian cancer. To this aim, both *in vivo* and *in vitro* studies will be conducted. In *in vivo* studies, in hens treated with the two mixtures of PAHs for 7 and 28 days, markers of ovarian cancer will be studied. These markers will allow to determine whether the neoplastic changes come from the ovary or from the oviduct. In *in vitro* studies, epithelial cells harvested from the ovary will be exposed to a mixture of 16 PAHs at concentrations corresponding to those determined in the blood and egg yolks of chickens after exposure to PAHs for 7 and 28 days. At this stage, the influence of PAHs on the processes of biotransformation, proliferation and apoptosis in epithelial cells will be examined. Especially important seems to be to determine the influence of PAHs on the biotransformation process, because the metabolites of PAHs formed in the first phase of biotransformation have carcinogenic properties and may contribute to the formation and development of neoplasms. Due to the similarity between ovarian cancer in women and in chickens, the use of a domestic chicken as a model in the study of the carcinogenesis process will allow the results to be compared with those obtained in humans.